Adding and Resolving Forces

Read from **Lesson 3** of the **Vectors and Motion in Two-Dimensions** chapter at **The Physics Classroom**:

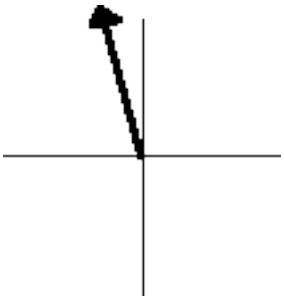
http://www.physicsclassroom.com/Class/vectors/u3l3a.html
http://www.physicsclassroom.com/Class/vectors/u3l3b.html

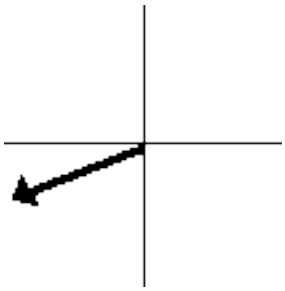
MOP Connection: Forces in Two Dimensions: sublevels 1 (mostly) and 3 (a little)

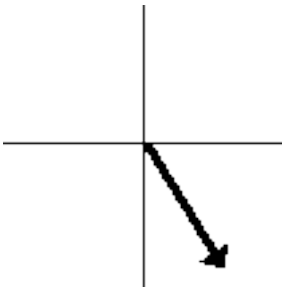
Review:

1. Quantities fully described by magnitude alone are _____; quantities that are described fully by both magnitude and direction are _____.

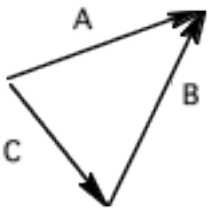
2. Use a protractor to estimate the direction of the following vectors using the CCW notation.





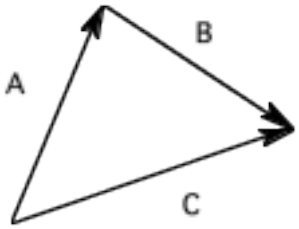


3. Identify the resultant in the following vector addition diagrams. Finally, indicate which two vectors were added to achieve this resultant (express as an equation such as X + Y = Z).



Resultant: _____

Eq'n: _____



Resultant: _____

Eq'n: _____

4. A vector component _____. Choose two. Be careful!
   a. describes the effect of a vector in a given direction.
   b. is found as the projection of a vector onto a coordinate axis.

Addition of Vectors and the Equilibrium Principle

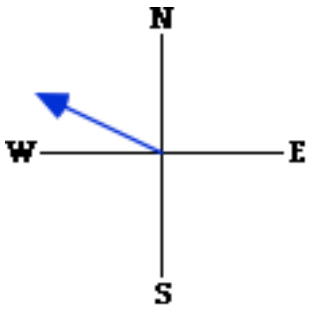
5. When vectors are added using the head-to-tail method, the sum is known as the resultant. When force vectors are added, the sum or resultant is also known as the _____.
   a. scalar b. average c. equilibrant d. net force

6. Several forces act upon an object. The vector sum of these forces ends up being 0 Newtons. The object is described as being _____.
   a. weightless b. at equilibrium c. stationary d. disturbed

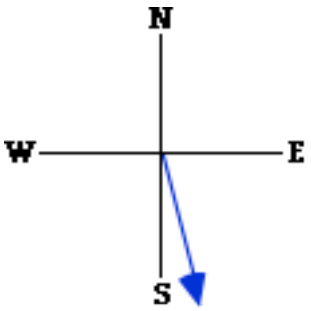
7. Which of the following is always true of an object that is at equilibrium? Select all that apply.
   a. The net force acting upon it is 0 Newtons.
   b. The individual forces acting upon it are balanced.
   c. The object is at rest.
   d. The object has no acceleration.
   e. The object has a constant (unchanging) velocity.

Resolving Forces into Vector Components

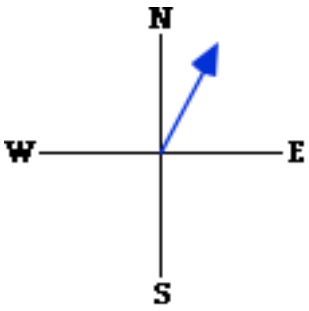
8. Consider the vectors below. Determine the direction of the two components by circling two directions (E, W, N or S). Finally indicate which component (or effect) is greatest in magnitude.



Components: **E W N S**
Greatest magnitude? _____

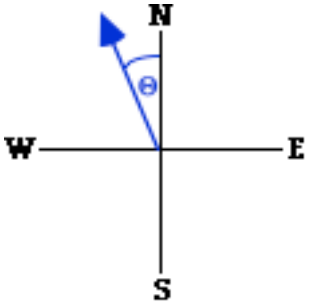


Components: **E W N S**
Greatest magnitude? _____

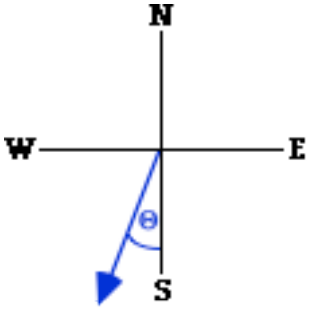


Components: **E W N S**
Greatest magnitude? _____

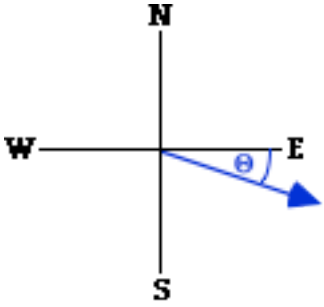
9. Each diagram displays a vector. The angle between the vector and the nearest coordinate axes is marked as theta (Θ). If Θ is gradually increased to 90 degrees, the magnitudes of the components would change. Which component would increase - horizontal (E/W) or vertical (N/S)?



Increasing component?
E W N S



Increasing component?
E W N S



Increasing component?
E W N S

10. For the following situations, draw and label the force components of the given vector. Then use trigonometric functions to determine the magnitude of each component. Label the magnitudes of the component on the diagram. **PSYW**

a. A 5.0 N force is exerted upon a dog chain at an angle of 65° above the horizontal.

b. A baseball is hit by a bat with a force of 325 N at a direction of 105°.